

WHAT IS CLAIMED IS:

1. A device for opening a shell containing a substance, the device comprising:
a shell containing a substance; and
5 a shape memory material activator configured to be deformed in response to only a single action and to subsequently create a path through the shell upon attainment of a predetermined temperature.
2. The device of Claim 1, wherein the single action produces a force on the shape
10 memory material activator.
3. The device of Claim 2, wherein the force deforms the shape memory material activator.
- 15 4. The device of Claim 1, wherein the single action is manual.
5. The device of Claim 1, wherein the single action is mechanical.
6. The device of Claim 1, wherein the single action is hydraulic.
20 7. The device of Claim 1, wherein the single action is pneumatic.
8. The device of Claim 1, wherein the single action is magnetic.
- 25 9. The device of Claim 1, wherein the single action is electromagnetic.
10. The device of Claim 1, wherein the single action is release of stored mechanical energy.
- 30 11. The device of Claim 1, wherein the path creation is repeatable with temperature cycling of the shape memory material activator.
12. The device of Claim 1, including a plurality of shells wherein the shape memory material activator creates a path on the plurality of shells.
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13. The device of Claim 1, wherein the shape memory material activator releases a force to create a path upon attainment of a predetermined temperature.
14. The device of Claim 1, wherein the shape memory material activator is coupled
5 with a bias spring element.
15. The device of Claim 1, wherein the single action changes the device from a dormant state to an active state.
- 10 16. A temperature activated actuator, comprising:
a shape memory material activator configured to be deformed in response to only a single action wherein
the actuator is placed in a state of readiness to respond to temperature changes
of the shape memory material activator.
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17. The actuator of Claim 16, wherein the single action produces a force on the shape memory material activator.
18. The method of Claim 17, wherein the force deforms the shape memory material
20 activator.
19. The actuator of Claim 16, wherein the single action is manual.
20. The actuator of Claim 16, wherein the single action is mechanical.
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21. The actuator of Claim 16, wherein the single action is hydraulic.
22. The actuator of Claim 16, wherein the single action is pneumatic.
- 30 23. The actuator of Claim 16, wherein the single action is magnetic.
24. The actuator of Claim 1, wherein the single action is electromagnetic.
25. The actuator of Claim 1, wherein the single action is release of stored
35 mechanical energy.

26. The actuator of Claim 16, wherein the single action is irreversible.
27. The actuator of Claim 16, wherein the shape memory material activator responds to temperature changes within a predefined temperature range.
- 5 28. The actuator of Claim 16, wherein the actuator releases a substance when the shape memory material activator responds to temperature changes.
- 10 29. The actuator of Claim 16, wherein the actuator activates another device when the shape memory material activator responds to temperature changes.
30. The actuator of Claim 16, wherein the actuator releases a force when the shape memory material activator responds to temperature changes.
- 15 31. The actuator of Claim 16, wherein the shape memory material activator is coupled with a bias spring element.
32. The actuator of Claim 16, wherein the single action changes the device from a dormant state to an active state.
- 20 33. The actuator of Claim 16, wherein the response is repeatable with temperature cycling of the shape memory material activator.
34. A method for arming a temperature activated device to release a substance, comprising:
25 deforming a shape memory material activator by a single action only, whereby the device is placed in an active state of readiness to release the substance when the shape memory material activator attains a predetermined temperature .
- 30 35. The method of Claim 34, wherein the single action produces a force on the shape memory material activator.
36. The method of Claim 35, wherein the force deforms the shape memory material activator.
- 35 37. The method of Claim 34, wherein the single action is manual.

38. The method of Claim 34, wherein the single action is mechanical.
39. The method of Claim 34, wherein the single action is hydraulic.
- 5 40. The method of Claim 34, wherein the single action is pneumatic.
41. The method of Claim 34, wherein the single action is magnetic.
42. The method of Claim 34, wherein the single action is electromagnetic.
- 10 43. The method of Claim 34, wherein the single action is release of stored mechanical energy.
44. The actuator of Claim 34, wherein the single action changes the device from a
- 15 dormant state to an active state.
45. A self-propelled device comprising:
a shape memory material activator configured with traction means, wherein;
the traction means enable the shape memory material activator to self propel.
- 20 46. The device of Claim 45, wherein the device self-propels along surface with traction means.
47. The device of Claim 45, wherein the device self-propels in a medium.
- 25 48. The device of Claim 47, wherein the medium is a mammalian body.
49. The device of Claim 47, wherein the medium is particulate media.
- 30 50. The device of Claim 47, wherein the medium is substance capable of sustaining the device.
51. The device of Claim 45, wherein the device travels on tracks.
- 35 52. The device of Claim 51, wherein the tracks are configured with traction means.

53. The device of Claim 45, wherein the shape memory material activator is trained in two way shape memory effect.
54. The device of Claim 45, wherein the shape memory material activator is
5 coupled with a bias spring element.
55. The device of Claim 54, wherein the bias spring is configured with traction means.
- 10 56. The device of Claim 55, wherein the shape memory material activator is coupled with a variable length body.
57. The device of Claim 56, wherein the variable length body is configured with traction means.
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58. The device of Claim 45, wherein the shape memory material activator is coupled with a variable length body and a bias spring element.
59. The device of Claim 45, wherein the device is a substance delivery device.
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60. The device of Claim 45, wherein the device is a medical device.
61. The device of Claim 45, wherein the device is a temperature device.
- 25 62. The device of Claim 45, wherein the device is a transporter.
63. The device of Claim 45, wherein the device is an actuator.
64. A self-propelled substance delivery system comprising:
30 a shape memory material activator configured with traction means and,
a track configured with traction means, wherein
the traction means enable the shape memory material activator to self propel
along the track and deliver a substance.
- 35 65. The system of Claim 64, wherein the track comprises a plurality of geometric shapes.

66. The system of Claim 64, wherein the track forms a closed loop.
67. The system of Claim 64, wherein the shape memory material activator travels
5 inside the track.
68. The system of Claim 64, wherein the shape memory material activator travels outside the track.
69. The system of Claim 64, wherein the shape memory material activator is trained
10 in two way shape memory effect.
70. The system of Claim 64, wherein the shape memory material activator is coupled with a bias spring element.
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71. The system of Claim 70, wherein the bias spring is configured with traction means.
72. The system of Claim 64, wherein the shape memory material activator is
20 coupled with a variable length body.
73. The system of Claim 72, wherein the variable length body is configured with traction means.
74. The system of Claim 64, wherein the device is substance delivery device.
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75. The system of Claim 64, wherein the device is a medical device.
76. The system of Claim 64, wherein the device is a temperature warning device.
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77. The system of Claim 64, wherein the device is a temperature indicator.
78. The system of Claim 64, wherein the device is a transporter.
79. The system of Claim 64, wherein the device is an actuator.
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80. The system of Claim 64, wherein the device is an implant.
81. The system of Claim 64, wherein the substance is delivered while the shape memory material is changing shape.
- 5 82. The system of Claim 64, wherein the substance is delivered along the track.
83. The system of Claim 64, wherein the substance is delivered upon contact with an object.
- 10 84. The system of Claim 64, wherein the track is a mammalian body cavity.
85. The system of Claim 64, wherein the track is a mammalian lumen.
- 15 86. The system of Claim 64, wherein the track is a tubular structure.
87. The system of Claim 64, wherein the track is a conduit.
88. The system of Claim 64, wherein the system changes the distance between two objects.
- 20 89. The system of Claim 64, wherein the system changes the distance between two or more points of an object.
- 25 90. A self-driven track system comprising:
a shape memory material activator configured with traction means and,
a track configured with traction means, wherein
the traction means enable the shape memory material activator to drive the track.
- 30 91. The system of Claim 90, wherein the track comprises a plurality of geometric shapes.
92. The system of Claim 90, wherein the track forms a closed loop.
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93. The system of Claim 90, wherein the shape memory material activator drives the track while anchored at one point along its body.
94. The system of Claim 90, wherein a plurality of shape memory material
5 activators drive a plurality of tracks.
95. The system of Claim 94, wherein the tracks is driven in the same direction.
96. The system of Claim 94, wherein the tracks are driven in different directions.
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97. The system of Claim 90, wherein the drive direction of the track is reversed with temperature cycling of the of the shape memory material activators.
98. The system of Claim 90, wherein the track is driven repeatedly with temperature
15 cycling of the shape memory material activator.
99. The system of Claim 90, wherein the shape memory material activator is trained in two way shape memory effect.
100. The system of Claim 90, wherein the shape memory material activator is
20 coupled with a bias spring element.
101. The system of Claim 100, wherein the bias spring is configured with traction means.
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102. The system of Claim 101, wherein the shape memory material activator is coupled with a variable length body.
103. The system of Claim 102, wherein the variable length body is configured with
30 traction means.
104. The system of Claim 102, wherein the variable length body is anchored at one point along its body.
105. The system of Claim 90, wherein the device is substance delivery device.
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106. The system of Claim 90, wherein the device is a medical device.
107. The system of Claim 90, wherein the device is a temperature warning device.
- 5 108. The system of Claim 90, wherein the device is a temperature indicator.
109. The system of Claim 90, wherein the device is a transporter.
110. The system of Claim 90, wherein the device is an actuator.
- 10 111. The system of Claim 90, wherein the device is an implant.
112. The system of Claim 90, wherein the substance is delivered while the shape memory material is changing shape.
- 15 113. The system of Claim 90, wherein the substance is delivered upon contact with an object.
114. The system of Claim 90, wherein the track is a tubular structure.
- 20 115. The system of Claim 90, wherein the track is a conduit.
116. An energy conversion system comprising:
a plurality of self-powered devices configured with traction means
25 a plurality energy transmission means configured with traction means, wherein;
the traction means allow for coupling of energy from the self-powered devices to energy transmission means.
117. The system of Claim 116, wherein the self-powered device is a shape memory material activator.
- 30 118. The system of Claim 117, wherein the shape memory material activator is trained in a two way shape memory effect.
- 35 119. The system of Claim 117, wherein the shape memory material activator is coupled with a bias spring element.

120. The system of Claim 119, wherein the bias spring is configured with traction means.

5 121. The system of Claim 117, wherein the shape memory material activator is coupled with a variable length body.

122. The system of Claim 121, wherein the variable length body is configured with traction means.

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123. The system of Claim 117, wherein the shape memory material activator is heated by ambient heating means.

124. The system of Claim 117, wherein the shape memory material activator is heated by forced heating means.

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125. The system of Claim 117, wherein the shape memory material activator is cooled by passive cooling means.

126. The system of Claim 117, wherein the shape memory material activator is cooled by forced cooling means.

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127. The system of Claim 117, wherein the self-powered devices comprise self-cooling means.

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128. The system of Claim 116, wherein the traction means comprises surface geometric features.

129. The system of Claim 116, wherein the traction means comprises surface roughness.

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130. The system of Claim 116, wherein the system converts thermal energy to mechanical energy.

131. The system of Claim 116, wherein the mechanical energy is produced as a linear motion.

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132. The system of Claim 116, wherein the mechanical energy is produce as a rotary motion.

133. The system of Claim 116, wherein the energy conversion is incremental.

134. The system of Claim 116, wherein the energy conversion is continuous.

135. The system of Claim 116, wherein the system is adaptable to energy conversion capacity changes.

136. The system of Claim 116, wherein the system is a substance delivery system.

137. A shape memory material activated device, the device comprising:
a plurality of shells containing a substance; and
a shape memory material activator variably deformed, wherein;
different parts of the shape memory material activator respond to different temperatures, within a predetermined temperature range, to create a path through the shell walls.

138. The device of Claim 137, wherein the shape memory material activator is variably deformed in the martensitic state.

139. The device of Claim 137, wherein the shape memory material activator is variably overdeformed at a temperature lower than the maximum temperature at which martensite can be stress-induced.

140. The device of Claim 137 wherein, the device comprises a single shell.

141. The device of Claim 137 wherein, the path creation takes places with rising temperature of the shape memory material activator.

142. The device of Claim 137 wherein, the path creation takes places with falling temperature of the shape memory material activator.

143. The device of Claim 137, wherein the shell is bounded by the porous barrier.

144. The device of Claim 137, wherein the device releases a substance.
145. The device of Claim 137, wherein the device admits a substance.
- 5 146. The device of Claim 137, wherein the substance is bounded by the porous barrier.
147. The device of Claim 137, wherein the shape memory material activator is an actuator.
- 10 148. The device of Claim 137, wherein the device is a substance delivery device.
149. The device of Claim 137, wherein the device is an implant.
- 15 150. The device of Claim 137, wherein the device is a warning device.
151. The device of Claim 137, wherein the path is created in response to changing ambient temperature.
- 20 152. The device of Claim 137, wherein the path is created in response to forcibly changing temperature of the shape memory material activator.
153. The device of Claim 137, wherein the path is created in response to a demand by a sensor responding to a stimulus.
- 25 154. A shape memory material activated device for opening a shell containing a substance, the device comprising:
a shell containing a substance bounded by a porous barrier;
a shape memory material activator configured to create a path through the shell upon
30 attainment of a predetermined temperature, whereby;
the substance passes through the porous barrier.
155. The device of Claim 154, wherein the substance is partially bounded by the porous barrier.
- 35 156. The device of Claim 154, wherein the shell is bounded by the porous barrier.

157. The device of Claim 154, wherein the shell is partially bounded by the porous barrier.
- 5 158. The device of Claim 154, wherein the porous barrier controls the release rate of the substance.
159. The device of Claim 154, wherein the device releases a substance.
- 10 160. The device of Claim 159, wherein the porous barrier controls the release rate of the substance.
161. The device of Claim 159, wherein the release of the substance is repeatable with the temperature cycling of the shape memory material activator.
- 15 162. The device of Claim 154, wherein the device admits a substance.
163. The device of Claim 162, wherein the porous barrier controls the admission rate of the substance.
- 20 164. The device of Claim 162, wherein the admission of the substance is repeatable with the temperature cycling of the shape memory material activator.
165. The device of Claim 154, wherein the shape memory material activator is coupled with a bias spring.
- 25 166. The device of Claim 154, wherein a pressure differential exists between the contents of the shell and the surrounding environment.
167. The device of Claim 154, wherein the porous barrier is compliant to volume changes of the shell.
- 30 168. The device of Claim 154, wherein the porous barrier is a permeable or semi-permeable membrane.
- 35 169. The device of Claim 154, wherein the porous barrier is a filter.

170. The device of Claim 154, wherein the porous barrier is a separator.
171. The device of Claim 154, wherein the device is an implant.
- 5 172. The device of Claim 154, wherein the device is a temperature warning device.
173. The device of Claim 154, wherein the device is a substance delivery system.
- 10 174. The device of Claim 154, wherein the device is a substance delivery system.
175. The device of Claim 154, wherein the device is a self-propelled with temperature cycling of the shape memory material activator.
- 15 176. The device of Claim 154, wherein the device is a fixed with temperature cycling of the shape memory material activator.
177. The device of Claim 154, wherein the path is created in response to changing ambient temperature.
- 20 178. The device of Claim 154, wherein the path is created in response to forcibly changing temperature of the shape memory material activator.
179. The device of Claim 154, wherein the path is created in response to a demand by a sensor responding to a stimulus.
- 25 180. A shape memory material activated device for opening a shell containing a substance, the device comprising:
a shell containing a substance; and
30 a shape memory material activator configured to create a path through the shell by pressure altering means.
181. The device of Claim 180, wherein the substance is partially bounded by the porous barrier.
- 35 182. The device of Claim 180, wherein the shell is bounded by the porous barrier.

183. The device of Claim 180, wherein the shell is partially bounded by the porous barrier.
184. The device of Claim 180, wherein the porous barrier controls the passage rate of the substance through the shell wall.
185. The device of Claim 180, wherein the device releases a substance.
186. The device of Claim 185, wherein the substance is released while the shape memory material activator changes temperature.
187. The device of Claim 186, wherein the substance is released through a porous barrier.
188. The device of Claim 186, wherein the release of the substance is repeatable with the temperature cycling of the shape memory material activator.
189. The device of Claim 180, wherein the device admits a substance.
190. The device of Claim 189, wherein the substance is admitted while the shape memory material activator changes temperature.
191. The device of Claim 189, wherein the substance is admitted through a porous barrier.
192. The device of Claim 189, wherein the admission of the substance is repeatable with the temperature cycling of the shape memory material activator.
193. The device of Claim 180, wherein the shape memory material activator is coupled with a bias spring element.
194. The device of Claim 180, wherein the shape memory material activator is coupled with a variable volume body.
195. The device of Claim 194, wherein the shape memory material activator forces the variable volume body to change volume.

196. The device of Claim 195, wherein the variable volume body changes the internal pressure of the shell.

5 197. The device of Claim 180, wherein the shell changes volume with the passage of the substance through the shell wall.

10 198. The device of Claim 180, wherein the shape memory material activator creates another path when subjected to a reverse temperature change within a predetermined temperature range.

15 199. The device of Claim 180, wherein the device releases a substance through one path within a predetermined temperature range and admits another substance through another path within another predetermined temperature range.

200. The device of Claim 199, wherein the substance release-admission cycle is repeatable with temperature cycling of the shape memory material activator.

20 201. The device of Claim 180, wherein the device admits a substance from a reservoir and releases a substance to another reservoir or the surroundings.

202. The device of Claim 180, wherein the device is an implant.

25 203. The device of Claim 180, wherein the device is a temperature warning device.

204. The device of Claim 180, wherein the device is a substance delivery system.

30 205. The device of Claim 180, wherein the path is created in response to changing ambient temperature.

206. The device of Claim 180, wherein the path is created in response to forcibly changing temperature of the shape memory material activator.

35 207. The device of Claim 180, wherein the path is created in response to a demand by a sensor responding to a stimulus.

208. A shape memory material activated device for delivering a substance, the device comprising:
a shell containing a substance; and
a shape memory material activator configured to create a path through the shell
5 when subjected to a temperature change within a predetermined temperature range, whereby;
the delivery of the substance effectively stimulates one or more senses.
209. The device of Claim 208, wherein the device releases a visual substance.
- 10 210. The device of Claim 208, wherein the device releases an olfactory substance.
211. The device of Claim 208, wherein the device releases a tactile substance.
- 15 212. The device of Claim 208, wherein the device releases a gustation substance.
213. The device of Claim 208, wherein the device produces an auditory signal upon release of the substance.
- 20 214. The device of Claim 208, wherein the device is a transdermal substance delivery device.
215. The device of Claim 208, wherein the device is a temperature warning device that stimulates one or more senses.
- 25 216. The device of Claim 208, wherein the device is a substance delivery system that stimulates one or more senses.
217. The device of Claim 208, wherein the device is a temperature alarm system that stimulates one or more senses.
- 30 218. The device of Claim 208, wherein the device is a toy that stimulates one or more senses.
- 35 219. The device of Claim 208, wherein the path is created in response to a demand by a sensor responding to a stimulus.

220. The device of Claim 208, wherein the path is created in response to changing ambient temperature.
- 5 221. The device of Claim 208, wherein the path is created in response to forcibly changing temperature of the shape memory material activator.
222. The device of Claim 208, wherein the substance release-admission cycle is repeatable with temperature cycling of the shape memory material activator.
- 10 223. The device of Claim 208, wherein the device is self-propelled with temperature cycling of the shape memory material activator.
224. A system of shape memory material activated substance delivery devices, the system comprising:
a plurality of shape memory material activated substance delivery devices configured to release their substances within predetermined temperature ranges, wherein;
the delivery of the individual substances collectively produce a combined effect.
- 15 225. The device of Claim 224, wherein the system is of variable scale.
226. The device of Claim 224, wherein the system is a mass substance delivery system.
- 25 227. The device of Claim 226, wherein the mass substance delivery system delivers a fragrance.
228. The device of Claim 226, wherein the mass substance delivery system delivers a drug.
- 30 229. The device of Claim 226, wherein the mass substance delivery system delivers a public health substance.
230. The device of Claim 3, wherein the mass substance delivery system delivers a mass control substance.
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231. The device of Claim 224, wherein the individual devices of the system respond to different temperatures of their respective shape memory material activators.

5 232. The system of Claim 224, wherein the individual substances are delivered in response to demands by sensors responding to a plurality stimuli.

233. The system of Claim 224, wherein the substances are delivered in response to changing ambient temperature.

10 234. The system of Claim 224, wherein the substances are delivered in response to forcibly changing temperature of their shape memory material activators.

15 235. The system of Claim 224, wherein delivery of the individual substances is repeatable with temperature cycling of the shape memory material activator.